

ISD Standards Committee Participation -- Recommendations

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Purpose/Scope of Activity

- **Assess current state of standards participation within the ISD and make recommendations for future involvement**
 - **Which standards bodies/committees provide the most potential to benefit ISD, in the following areas:**
 - Development/operations cost savings (through increased reuse, increased use of commercial solutions, etc.)
 - Enabler of mission concepts not currently feasible
 - **What should ISD's level of involvement be for standards development?**
 - Are more/less resources required than currently expended?
 - Which standards bodies should we actively participate in during the standards development process, and which standards should we merely maintain "awareness of"?
- **Study "logistics"**
 - "Interviewed" domain experts within ISD/AETD to gather information on current standards effort/get opinions on future recommendations
 - Completed task during 1st quarter of CY 2004.

Standards Efforts, Survey and Assessments

- Mission Systems Engineering
- Flight Software Development
- Ground Data Systems and Mission Operations Center Engineering
- Science Data Processing
- Information Technology Management

Mission Systems Engineering

- Background:
 - Major area of focus is development of data representation standards for systems engineering data (e.g., requirements, design information, etc.).
 - Several system engineering tools which exist support “emerging” standards
 - Led at GSFC by Code 592
- Current ISD resources: No dedicated resources
- Recommendations: Dedicate 0.1 FTE to review/comment on emerging SE data standards as they apply to ISD domain areas
- Benefits:
 - SE data standards, when adopted, may facilitate reuse of “soft copies” of critical SE data for missions with similar objectives
 - Could result in time/effort savings during formulation

Flight Software Development

- **Background:**
 - Flight software standards currently being addressed by CCSDS Spacecraft Onboard Interface Services (SOIS) area, including:
 - Spacewire (physical/data link layer) standard for flight communications
 - Network services/transport layer standard to run on top of spacewire
 - Applications layer standard interfaces
 - Participation primarily from Codes 582 and 560
- **Current ISD resources: ~1.5 FTEs (CS/CTR) support current CCSDS SOIS activities**
- **Recommendations: Continue current activities at present staffing level**
- **Benefits:**
 - Standard communications/message structure mechanisms could enhance future FSW reuse opportunities
 - Some missions (JWST, GOES-R) planning FSW capabilities implementing portions of SOIS standards

Ground Data Systems/Mission Ops Engineering (1 of 4)

- **Background:**
 - Several CCSDS working groups exist developing standards addressing telemetry, telecommand, tracking, and applications-layer standards between ground system components.
 - Current ISD efforts:
 - Leadership in definition of/prototyping CCSDS File Delivery Protocol (CFDP)
 - Participation in OMG Space Domain Task Force
 - Participation in definition of CCSDS Proximity-1 protocol standards
- **Current ISD resources: ~0.5 CS FTE, ~0.5 CTR FTE (OMG), 11K year OMG dues**

Ground Data Systems/Mission Ops Engineering (2 of 4)

- **Recommendations:**

- **Continue CFDP/Proximity-1 efforts as currently scoped/staffed:**

- CFDP provides several potential benefits, including:
 - Increased data quality
 - More autonomous Solid State Recorder management operations
 - Elimination of LZP
 - Prox-1 provides standard for space-space communications, potentially beneficial to constellation class missions

Ground Data Systems/Mission Ops Engineering (3 of 4)

- **Recommendations (cont.):**
 - **Consider increased participation in following CCSDS working groups:**
 - **Next Generation Space Internet working group (0.5 FTE)**
 - Intent of effort is to facilitate adoption of industry-standard IP protocols by CCSDS
 - » IP-in-space provides potential for cost savings in I&T/ops areas, and enables mission concepts not easily achievable today
 - Benefits of working group participation probably more political than technical
 - » Participation may not be needed/required if agency sanctions use of commercial IP standards for space use
 - **CCSDS Security Working Group (0.5 FTE)**
 - Intent of effort is to define a cost-effective solution for uplink encryption and authentication within existing CCSDS standards base
 - » Agency/Center placing increased emphasis on space asset security
 - » Existing NSA-approved methods/approaches are costly
 - Not clear if an international standards body can effectively define a standard addressing a domestic (U.S. Civil Space) security issue

Ground Data Systems/Mission Ops Engineering (4 of 4)

- Recommendations (cont.):
 - **Discontinue OMG Space Domain Task Force (SDTF) participation**
 - Focus of OMG SDTF efforts oriented towards developing applications-layer standards
 - With exception of Telemetry and Command (T&C) database standard, progress in standards development has not been significant.
 - 3rd party Vendor participation has fallen short of expectations to date

Science Data Processing

- **Background:**
 - Code 586 provides leadership/active involvement in HDF (earth science) and CDF (space science) data format standards definition efforts
 - Standards definition efforts underway to:
 - Develop science data format standards for earth and space science products to facilitate wider use by other government information systems
 - Develop middleware standards to enable/facilitate development of dynamic/run-time architectures for science data processing, versus today's resource-fixed, schedule-driven systems.
- **Current ISD resources: ~1.5 FTEs**
- **Recommendations: Continue current activities at present staffing level**
- **Benefits:**
 - Current HDF and CDF standards efforts are appropriate for current set of science data processing problems
 - Not clear if there are sufficiently mature science data processing concepts which require/could take advantage of other cutting-edge standards efforts identified above.

Information Technology Management

- **Background:**
 - IT standards definition activities within agency address issues such as desktop architecture standards, information exchange standards, and IT security
 - GSFC CIO, Codes 290/297 lead Center efforts, ISD provides review/comment supporting role when solicited.
- **Current ISD resources: No dedicated resources**
- **Recommendations: Dedicate 1.0 FTE to work closely with NASA CIO, Codes 290/297 for IT standards development**
- **Benefits:**
 - Standards development is currently a “push-down” to ISD, not a collaborative effort
 - Difficult at times for ISD to influence standards development/influence IT budgets under current environment
 - Assignment of dedicated individual better positions ISD to influence emerging standards to ensure technical feasibility and cost realism.

Management/Administration of Center standards efforts

- Currently, Code 595 (Felipe Flores-Amaya) manages CCSDS standards activities/associated budget, with inputs from other organizations (Codes 450, 580) as needed
- ISD has potential opportunity to acquire a leadership role for this activity
- Advantages:
 - Leadership of standards activities provides mechanism for ISD to influence efforts conducted by CCSDS working groups to best benefit division activities.
- Disadvantages:
 - Requires qualified, dedicated personnel (~1.5 FTEs) assigned to effort
 - Not clear from results of survey if there are sufficient standards development needs within the ISD which justify the personnel investments required.

Summary of Recommendations by Functional Area

ISD functional area	Current est. stds. support (FTEs)	Rc'd stds. support (FTEs)	Rationale
Mission Systems Engineering	0	0.1	Working knowledge of SE data standards such as STEP
Flight Software Development	1.5	1.5	Continue current efforts as staffed
Ground System & MOC Engineering	0.5	1.5	Continue current CFDP/Prox-1 efforts, add support for CCSDS-IP, CCSDS-SP
Science Data Processing	1.5	1.5	Continue current efforts as staffed
IT Management	0	1	Establish “collaborative” relationship with CIO/200 for future IT standards development
TOTALS	3.5	5.6	

Conclusions

- Much of current standards participation within ISD appears appropriate from both a technical and staffing perspective
 - Lone exception is OMG experience, should reconsider future participation based on progress to date
- Few near-term (by end of decade) mission needs which drive the need for additional technical standards definition/development
 - CCSDS/IP collaboration may be politically beneficial, but probably not crucial to future implementation efforts
- Technical initiatives to decrease ISD cost of doing business (I.e., GMSEC) already underway internally
 - May consider collaboration with standards bodies as GMSEC efforts mature
- Near-Term additional ISD standards efforts should focus on process improvement (CMM activities)
 - Best chance for achieving additional ISD development cost savings/efficiencies based on industry experiences
 - Standardizing practices within the ISD could facilitate an increase in product quality for all division-led development efforts.